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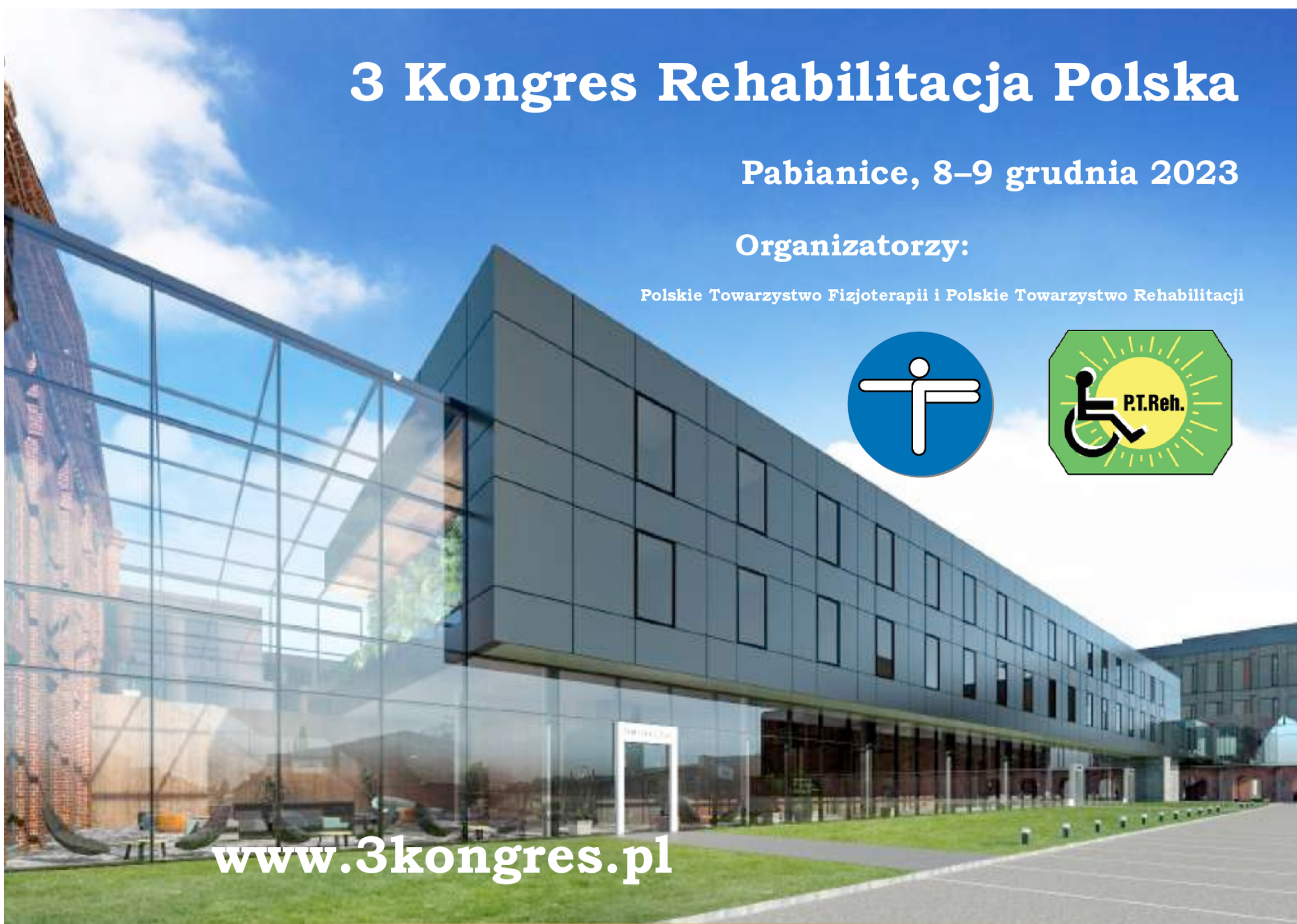

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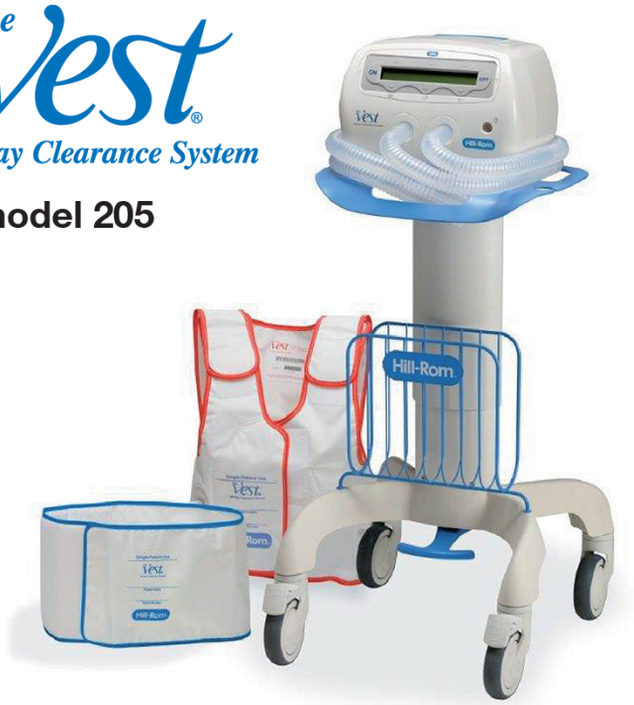

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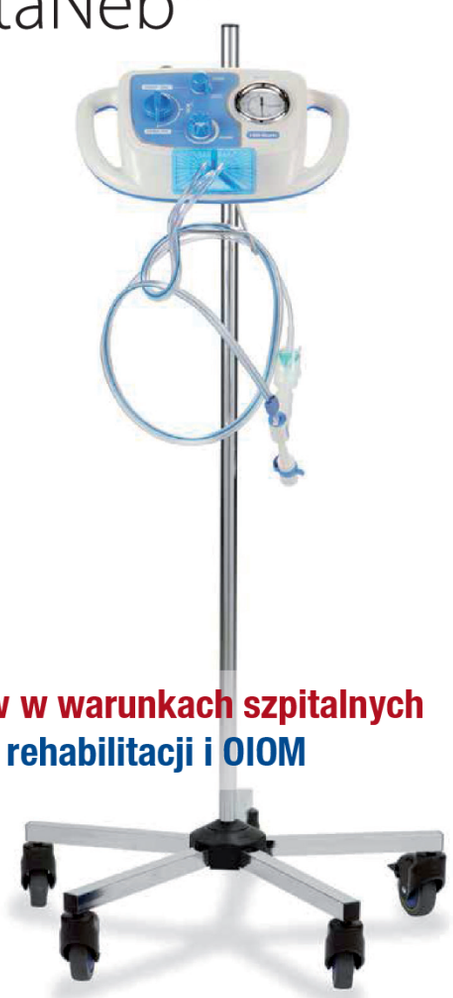

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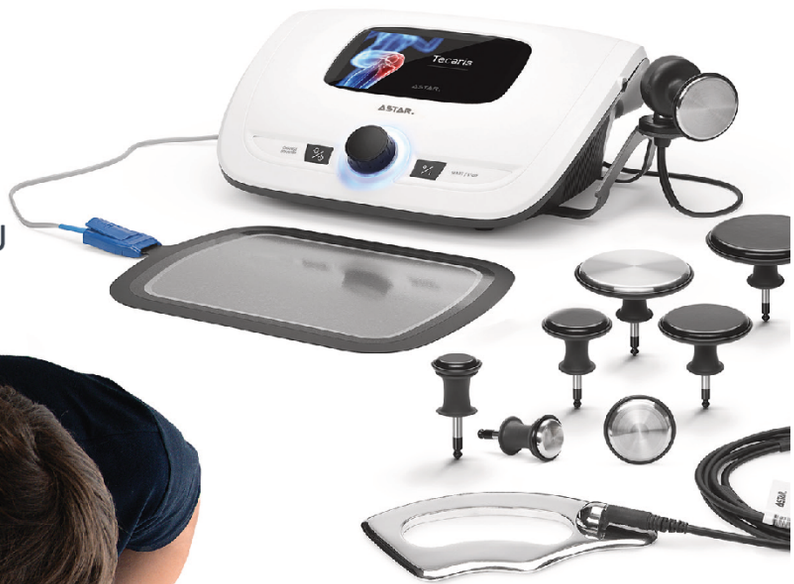

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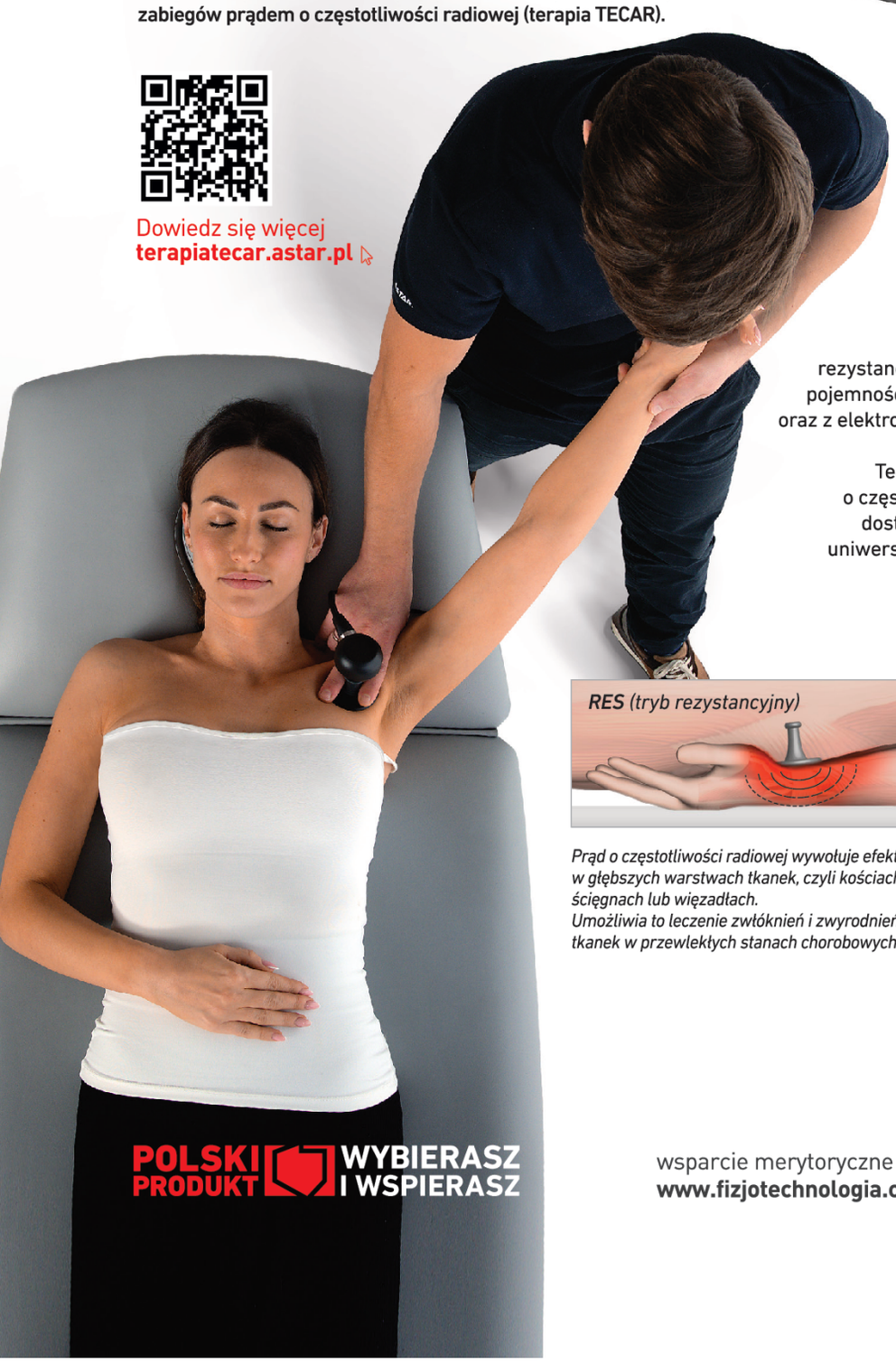

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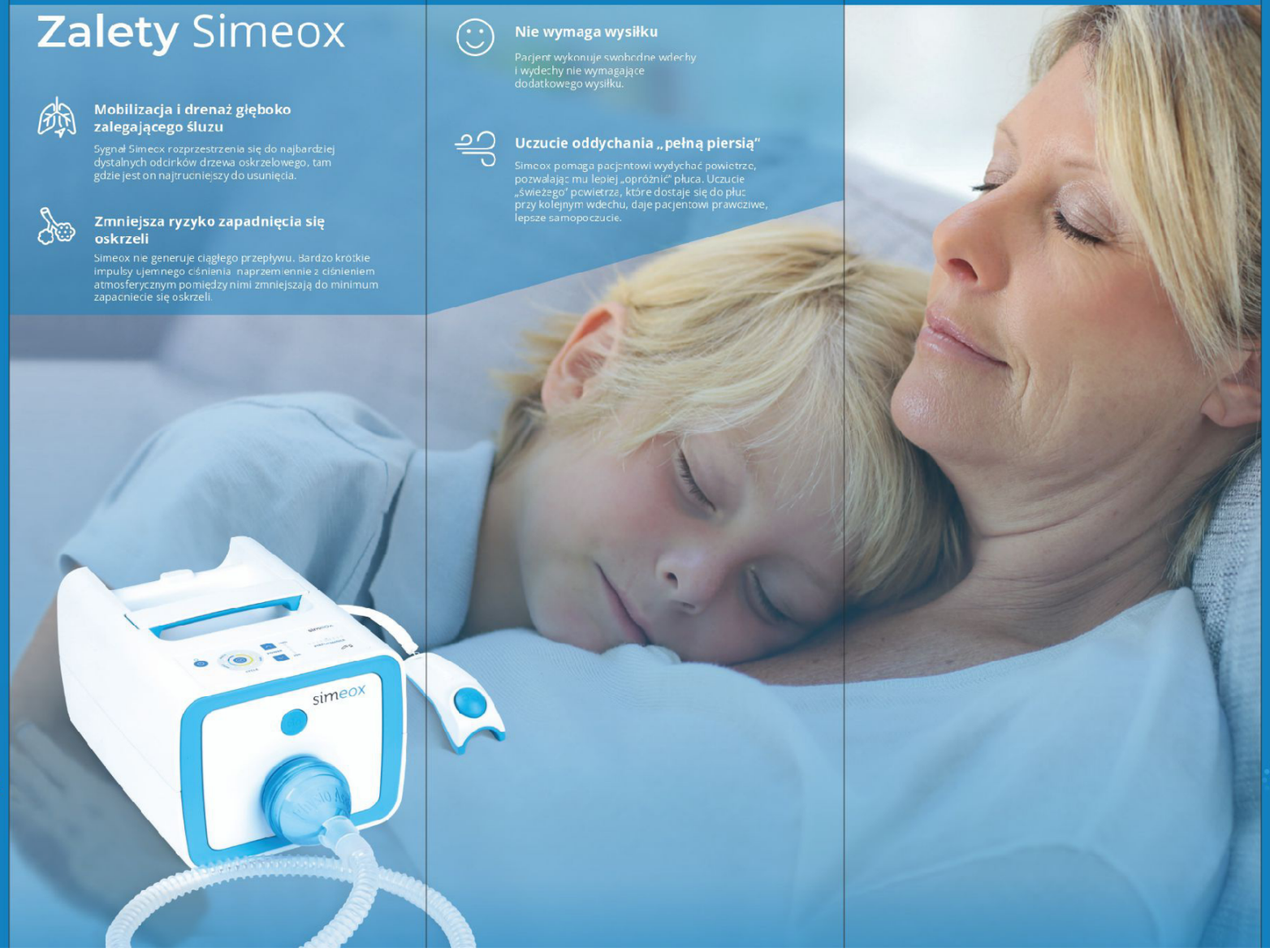

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Aerobic and mobility training exercises effectiveness for undergraduate students: an experimental study

Skuteczność ćwiczeń aerobowych i treningu mobilności dla studentów studiów licencjackich: badanie eksperymentalne

Taufik Rihatno[1(A,C,D,E)], Kristia Estilo[2(A,C,D,E)], Edi Setiawan[3(A,C,D,E)], Jason Agupitan[4(A,C,D,E)], Vasile Catalin Ciocan[5(A,C,D,E)], Jasper John De Castro[6(A,C,D)], Lou Margarett Parcon[7(A,C,D)], Mike Jhun Valencia[8(A,C,D)], Kathlyn Sison[9(A,C,D)], Joseph Lobo[10(A,B,C,D)], Sri Nuraini[1(A,C,D)], Bachtiar[11(A,C,D)]

[1]Universitas Negeri Jakarta, Indonesia
[2]West Visayas State University- Janiuay Campus, Iloilo, Philippines
[3]Universitas Suryakancana, Indonesia
[4]Northern Iloilo State University, Iloilo, Philippines,
[5]University Vasile Alecsandri of Bacau, Romania
[6]Romblon State University, Romblon, Philippines
[7]Pototan National Comprehensive High School, Iloilo, Philippines
[8]Malay College, Aklan, Philippines
[9]Milan National High School, Department of Education, Iloilo, Philippines
[10]Mabalacat City College, Mabalacat City, Philippines
[11]Universitas Muhammadiyah Sukabumi, Indonesia

Abstract

There have been a number of studies conducted on the benefits of aerobic and mobility training for enhancing BMI. However, its usefulness in a virtual classroom setting has not been tested in any academic studies. The purpose of this controlled experiment is to determine whether or not different types of aerobic and mobility training lead to significant improvement in body mass index among study participants. This study has employed an experimental research design in which the students will undergo a series of aerobic and mobility training exercises for four consecutive weeks while accounting for participants' gender and BMI. The participants for the study are one section of undergraduate students from a college in the Philippines. A survey questionnaire with two parts was utilized. For the first part, personal profiles such as gender and pre-test Body Mass Index are all included. The second part requested the participants to answer the Physical Activity Readiness Questionnaire (PAR-Q). After performing the series of exercises, it was found that a significant difference was observed between male and female students concerning their performance, in which male students performed better compared to their counterparts. Most importantly, a significant difference was observed between the pre-test and post-test scores of the students. It can be concluded that the various aerobic and mobility training exercises are efficient for students in improving their BMI, even in an online learning environment. The continuous use of the following exercises is highly recommended. Finally, practical implications, limitations, and future research directions are also presented.

Keywords

aerobic exercises, mobility training exercises, online learning environment, physical education, undergraduate students

Streszczenie

Przeprowadzono wiele badań nad korzyściami płynącymi z treningu aerobowego i mobilności w celu poprawy wskaźnika BMI. Jednakże jego przydatność w środowisku wirtualnej klasy nie była testowana w żadnych badaniach akademickich. Celem tego kontrolowanego eksperymentu jest ustalenie, czy różne rodzaje treningu aerobowego i mobilności prowadzą do znaczącej poprawy wskaźnika masy ciała wśród uczestników badania. Badanie to wykorzystało eksperymentalny projekt badawczy, w którym studenci poddani zostali serii ćwiczeń aerobowych i z mobilności przez cztery kolejne tygodnie, uwzględniając płeć uczestników oraz ich BMI. Uczestnikami badania jest jedna grupa studentów licencjackich z kolegium na Filipinach. Wykorzystano ankietę składającą się z dwóch części. W pierwszej części zawarte są profile osobiste, takie jak płeć i wskaźnik BMI przed testem. Druga część prosiła uczestników o odpowiedź na Kwestionariusz Gotowości do Aktywności Fizycznej (PAR-Q). Po przeprowadzeniu serii ćwiczeń stwierdzono, że zaobserwowano znaczącą różnicę między studentami płci męskiej a żeńskiej pod względem ich wyników, przy czym studenci płci męskiej osiągnęli lepsze wynik. Co najważniejsze, zaobserwowano znaczącą różnicę między wynikami przedtestowymi a potestowymi studentów. Można zatem stwierdzić, że różne ćwiczenia aerobowe i z zakresu mobilności są skuteczne dla studentów w poprawie ich BMI, nawet w środowisku nauczania online. Zaleca się ciągłe korzystanie z tych ćwiczeń. Na koniec przedstawiono również praktyczne implikacje, ograniczenia oraz kierunki przyszłych badań.

Słowa kluczowe

ćwiczenia aerobowe, ćwiczenia z zakresu mobilności, środowisko nauczania online, edukacja fizyczna, studenci

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Introduction

For the past couple of years, ennui to several physical activities has already been regarded as a global pandemic [1]. The percentage of individuals who are not actively engaged in physical activities is rising, particularly among young adolescents such as college students [2, 3]. Most importantly, during this time, because of the widespread catastrophe brought about by the COVID-19 pandemic, the normal way people live have been deeply altered [4, 5]. Another major reason is that higher education institutions around the globe have been forced to close drastically shifting from the traditional face-to-face setting to an online learning environment. This unforeseen change in the academic environment had a negative impact on the lives of college students, which resulted in issues with their physical health [6, 7], even in the Philippines [8–10]. Globally, and even in the Philippines, the focus of online physical education classes is on students' health and fitness, and educators are attempting to engage their students in health régime, which may help to enhance their physical health even in the comfort of their homes. A reduction in the amount of time spent being active can have a negative influence on an individual's fitness level, causing a decline in muscular strength, agility, and flexibility, as well as cardiorespiratory endurance and body composition [11–13]. Even with technological developments, the social and experience components of physical education cannot be adequately reflected online [14]. Physical education has disastrous consequences when its genuine objective and value are not successfully communicated as a result of course repetition in constrained environments and ineffective educational materials [15]. It was also reported that virtual physical education courses have no observable effect on students' tendency to engage in physically demanding activities or their development of motor skills [16]. Reduced motivation and interest, as well as fewer opportunities for meaningful peer connections, may be due to these factors. The information presented so far shows that delivering online courses is problematic even after the outbreak. PE classes may not adapt to being taught online.

Purpose of the study

In this regard, this study is aimed on examining the effectiveness of physical activities such as aerobic and mobility training exercises on undergraduate students from a college in the Philippines in an online learning modality.

Materials and methods

Research design

This study employed an experimental design to compare the participants' Body Mass Index before and after they completed the series of aerobic and mobility training exercises for 4 consecutive weeks.

Instruments and data gathering procedure

To collect the data from the participants, a survey questionnaire with two parts was utilized. For the first part, personal profiles such as gender and pre-test Body Mass Index are all included. The second part requested the participants to answer the Physical Activity Readiness Questionnaire (PAR-Q). All participants that were identified with medical history are automatically ineligible to partake in the experiment.

The participants were given a list of exercises for both aerobic (marching, side to side, point step, bleking step, v-step, grapevine, leg-up, single/double squat, and leg curl) and mobility training (paint the fence, wax on/off, black burns, cosax squats, hip-pull around the world-lateral lunges, squat stand with arm extension, and squat internal rotation) exercises, all of which are first discussed in class. Students will take the aforementioned exercises for a period of 4 weeks. The instructor (researcher) will go over the crucial steps in performing the exercises with the students during a specific week before they are to be performed. The class was delivered in an online format; therefore, the students were also given a video clip and a module that explained how to complete the subsequent examinations. The course design that students must undergo each week are shown in Table 1.

Table 1. Course design for 4 weeks

Week	Exercises/Activities	Week	Exercises/Activities
1	Body Mass Index assessment (pre-test)	4	• Black burns • Cosax Squats (Right and Left)
2	Aerobic Exercises • Marching (Forward, Backward, Sides) • Side to side • Point step • Bleking step • V-Step • Grapevine • Leg-up • Single/Double Squat • Leg curl	5	• Hip-pull around the world-Lateral lunges • Squat stand with arm extension • Squat internal rotation Body Mass Index assessment (post-test)
3	Mobility Training Exercise • Paint the fence • Wax on/off		

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Participants of the study

The participants for the study are from one: (1) section of first-year undergraduate students taking the degree of Bachelor of Physical Education in a college in the Philippines enrolled in the course Physical Activities Toward Health and Fitness–Exercise-Based Fitness Activities for the 2nd Semester, the Academic Year 2021-2022. Additionally, participants are selected using Judgmental Sampling Technique. It is a non-probability sampling technique in which people take part in the study based on the researcher's subjective assessment of who will produce the most useful data for meeting the goals of the research [17]. In this regard, a selection criterion is formulated in order to acquire the most reliable data possible from the participants. The following criteria are as follows:

• Can be either male or female.
• Should not have any medical history.

The personal profiles of the participants are illustrated in Table 2, which includes information about their genders, and pre-test Body Mass Index (BMI). According to the data, there were a total of fifty (50) students participated in the experiment project, with the majority of the participants being females [(N_{female} = 33(66.00%), N_{male} = 17(34.00%)]. Lastly, in terms of participants' body mass index (BMI) for the pre-test, the majority of them fall into the normal category, followed by those underweight and overweight [(N_{normal} = 34(68.00%), $N_{underweight}$ = 12(20.00%), $N_{overweight}$ = 6(12.00%)].

Table 1. Demographic characteristics

Variuables	Items	N (%)
	Orthodox approach	
Gender	Male	17 (34.0%)
	Female	33 (66.0%)
BMI (Pre-test)	Underweight (UW)	10 (20.0%)
	Normal (N)	34 (68.0%)
	Overweight (OW)	6 (12.0%)

Monitoring procedures activity-specific skills program adherence

The study employed two methods to ensure that participants actually completed the physical fitness test: (1) having them submit an index card in the college-mandated format detailing the exercises they took and Body Mass Index (post-test), and (2) having them submit unedited and uncut video recordings of themselves performing the exercises. Both of the required monitoring tools were uploaded to Google Drive by the participants. Students are expected to submit the following weekly as evidence of their continued engagement with the exercises. Amazingly, 100% of the participants met the criteria and turned in their work on time.

Statistical analysis

The data was processed with IBM SPSS 27 (IBM Statistical Package for the Social Sciences). The demographic profile (gender, pre- and post-test BMI) were interpreted using descriptive statistics like frequency (f), percentage (%), mean (M), and standard deviation (SD). Table 3 provides a visual depiction of the tabular description of each fitness test. Additionally, Independent Samples T-Test was performed to assess whether or not there was a statistically significant difference in the BMI (post-test) scores of participants after performing the aerobic and mobility training exercises with respect to gender. It is a parametric test that compare the means of two independent groups [18, 19]. Lastly, the Paired samples t-test was used to assess the significant difference between the pre-test and post-test IBM scores of the participants after performing both set of exercises [20].

Ethical considerations

The participants knew the objectives, techniques, and exercises used to measure their performance during the experiment. It has also been explained how the inquiry will benefit academic institutions and the scientific community.

Results

Table 3 typifies the Body Mass Index (BMI) – pre-test classification of the participants with respect to gender. Regarding age, most of the male participants falls under the normal classification, followed by those who are overweight and underweight [($N_{male(normal)}$ = 14(82.35%), $N_{male(overweight)}$ = 2(11.76%), $N_{male(underweight)}$ = 1(5.89%)], while female participants fall under the normal classification, followed by those who are underweight and overweight [($Nf_{emale(normal)}$ = 20(60.61%), $N_{male(underweight)}$ = 9(27.27%), $N_{male(overweight)}$ = 3(12.12%)].

Table 3. Contingency Table on gender and Body Mass Index (pre-test)

Gender	Underweight/UW (%)	Normal/N (%)	Overweight/OW (%)
Male	1 (5.89%)	14 (82.35%)	2 (11.76%)
Female	9 (27.27%)	20 (60.61%)	4 (12.12%)

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Table 4 illustrates the results in the performance and improvement of the participants' BMI after performing the aerobic and mobility training exercises after four (4) weeks. Based on the findings, a significant difference was observed [t(37.827) = 2.466, p = 0.018] between genders to which the male participants (23.00 ± 2.59) performed better than females (20.97 ± 3.08).

Table 4. Independent Samples T-test measuring the difference in the Body Mass Index of participants after performing the aerobic and mobility training exercise

BMI (post-test)	N	M ± SD	SE	df	t-test	Sig.	Decision
Male	17	23.00 ± 2.59	0.627	37.821	2.466	0.018	Significant
Female	33	20.97 ± 3.08	0.535				

Table 5 displays the results on the significant difference between the pre- and post-test performance of students with respect to their Body Mass Indexes. The findings revealed a significant difference and improvement was observed to which the post-test scores (21.66 ± 3.05) are considerably higher compared to participants' pre-test scores (21.28 ± 3.07) after performing the aerobic and mobility training exercises after 4 consecutive weeks [t(49) = −2.243, p = 0.029], which is highly evident based as illustrated also in Table 6.

Table 5. Pre-test versus post-test scores after performing the aerobic and mobility training exercise

	Paired Differences						
			95% Confidence Interval of the Difference				
	M ± SD	SE	Lower	Upper	t	df	Sig.
Pre-test − post-test	−0.38 ± 1.19	0.168	0.71517	0.03922	−2.243	49	0.029

Table 4. Results of selected physical fitness tests (orthodox versus virtual approach)

Post-test						Pre-test					
Participants	BMI	Class	Participants	BMI	Class	Participants	BMI	Class	Participants	BMI	Class
1	20.48	2	26	16.80	1	1	20.20	2	26	17.20	1
2	22.20	2	27	18.79	2	2	21.50	2	27	19.20	2
3	22.10	2	28	22.40	2	3	24.20	2	28	24.90	2
4	23.50	2	29	21.00	2	4	24.90	2	29	22.40	2
5	19.80	2	30	17.60	1	5	18.40	1	30	18.70	2
6	23.05	2	31	23.50	2	6	24.29	2	31	24.80	2
7	18.47	1	32	28.29	3	7	17.57	1	32	28.29	3
8	24.70	2	33	20.40	2	8	25.10	3	33	21.20	2
9	20.00	2	34	20.00	2	9	20.00	2	34	21.30	2
10	24.00	2	35	18.00	1	10	25.00	3	35	18.00	1
11	21.97	2	36	21.00	2	11	24.70	2	36	22.40	2
12	23.90	2	37	22.50	2	12	22.10	2	37	23.20	2
13	26.57	3	38	24.20	2	13	26.10	3	38	24.20	2
14	15.10	1	39	24.20	2	14	15.82	1	39	23.28	2
15	18.29	2	40	17.00	1	15	17.20	1	40	17.80	1
16	21.65	2	41	23.30	2	16	24.32	2	41	23.70	2
17	21.00	2	42	19.40	2	17	21.20	2	42	21.40	2
18	19.00	2	43	21.00	2	18	19.00	2	43	21.25	2
19	22.20	2	44	18.21	1	19	20.20	2	44	18.61	2
20	22.26	2	45	18.66	2	20	22.65	2	45	19.50	2
21	24.06	3	46	18.33	1	21	22.70	2	46	19.01	2
22	20.30	2	47	23.55	2	22	21.60	2	47	24.00	2
23	19.10	2	48	16.88	1	23	18.90	2	48	16.88	1
24	27.00	3	49	25.10	3	24	24.30	2	49	23.80	2
25	15.70	1	50	27.50	3	25	17.50	1	50	28.40	3

Class: 1 – Underweight, 2 – Normal, 3 – Overweight

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Discussion

Researchers have focused their efforts over the past several years on determining whether or not aerobic activities and mobility training exercises are beneficial in improving the body mass index of students from a variety of population samples [21–23]. However, research concentrating on the effectiveness of these activities in an online learning environment, in which teachers give students the opportunity to complete these strenuous tasks in the convenience of their own homes without supervision, have not yet been uncovered. As a direct result of this, a study was carried out. Following participation in a variety of aerobic and mobility training activities, the data demonstrate that male undergraduate students have demonstrated superior performance when compared to their counterparts in this regard. It has been established in a wide range of scholarly publications that males are significantly superior to females in terms of performance across a variety of sports and other physically demanding endeavors [24–26]. In a positive development, inclusive policies have been implemented in many countries with the aim of getting female students to take part in more physical activity, which is beneficial to their overall well-being [27–29]. Also, there was no discrimination of any kind based on gender in the administration of this experiment. Therefore, although the results show that male students perform better than girls, it is still worth noting that participants of both sexes increased their performance in these activities and saw significant improvements in their Body Mass Index (BMI).

Last but not least, it was found that the students' body mass index (BMI) levels dramatically improved from pre to post testing after they had participated in the aerobic and mobility training exercises for a total of four consecutive weeks in an entirely online environment. On the basis of the results, it is possible to draw the inference that it is possible to carry out these activities in a setting that facilitates distance or online learning. Scholarly articles have reported the usage of different technologically advanced apparatuses that can encourage students to participate in greater physical activities including aerobic and mobility training. To give just one example, evidence by [30] has shown that VR exercises have the ability to improve physiological outcomes (such BMI) more so than conventional workouts. The usage of a virtual reality platform provides beneficial effects in terms of cognitive flexibility and selective attention, as indicated by [31] in their preliminary findings. In addition, [32] research on the efficacy of a virtual fitness trainer app called TRAINIME found that students reported feeling more motivated to engage in fitness activities following practice sessions with the virtual fitness trainers and that they found the activities to be interesting, fun, and uplifting. While the aforementioned pieces of evidence point to the potential of technological tools to increase student participation in physical activities, they do not address the effect of such tools on students' BMIs. In addition, the format of these studies is indeed not ideal for a virtual classroom. These can be accounted for by the fact that there is a dearth of research articles discussing the efficacy of aerobic and mobility training exercises in the setting of distance education. Therefore, it is strongly suggested to do a comparable study to further determine the efficacy of these types of activities.

It was also shown that students' levels of physical activity and body mass index were influenced by a number of other factors. [33, 34], and [35] have all emphasized that food patterns are significantly connected with body mass index, which may drastically effect individual physical activity performance. This suggests that a greater score of unhealthy patterns correlates with a higher BMI, and vice versa. There was also a significant association between BMI and factors associated to individual lifestyle choices. Many different aspects of an individual's way of life have been linked to obesity [36–39], a lack of exercise, tobacco use, and alcohol intake. Future studies may find it interesting to investigate the impact of the aforementioned elements on students' physical activity levels, particularly their participation in aerobic and mobility training exercises, in relation to their body mass index.

Conclusion

Undergraduate students of all sizes benefited from learning about and participating in a variety of aerobic and mobility training activities in a virtual classroom setting over the course of 4 consecutive weeks. Furthermore, the study's findings provided useful information that the following aerobic and mobility training exercises offered to undergraduate students can be employed by physical education teachers to improve students' body mass indexes. Further studies with larger sample size may be conducted in order to determine if the findings of this study may be supported or repudiated.

Adres do korespondencji / Corresponding author

Taufik Rihatno

E-mail: trihatno@unj.ac.id

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